(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 July 2001 (05.07.2001)

PCT

(10) International Publication Number
WO 01/47933 A1

(51) International Patent Classification[7]: C07D 495/04, A61K 31/55, A61P 25/18

(21) International Application Number: PCT/GB00/04982

(22) International Filing Date:
22 December 2000 (22.12.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
977/BOM/99 28 December 1999 (28.12.1999) IN
09/540,749 31 March 2000 (31.03.2000) US

(71) Applicant *(for all designated States except US)*: **CIPLA LIMITED** [IN/IN]; 289 Bellasis Road, Mumbai Central, Mumbai 400 008 (IN).

(71) Applicant *(for MW only)*: **WAIN, Christopher, Paul** [GB/GB]; A.A. Thornton & Co. 235 High Holborn, London WC1V 7LE (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **HAMIED, Yusuf, Khwaja** [IN/IN]; Windsor Villa, 2nd Floor, Westfield Estate, Off Bhulabhai Desai Road, Mumbai 400 026 (IN). **KANKAN, Rajendra, Narayanrao** [IN/IN]; A 3/5, NBD Society, Netaji Palkar Marg, Opp. Home Guards, Ghatkopar (West), Mumbai 400 084, Maharashtra (IN). **RAO, Dharmaraj, Ramachandra** [IN/IN]; 204 Shriji Krupa, Swaminarayannagar, Pokhran Road 1, Thane 400 601, Maharashtra (IN).

(74) Agents: **WAIN, Christopher, Paul** et al.; A.A. Thornton & Co. 235 High Holborn, London WC1V 7LE (GB).

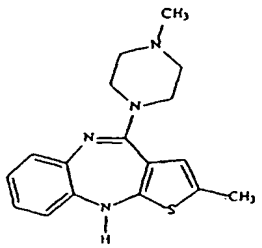
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
--- *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: NEW POLYMORPHIC FORMS OF OLANZAPINE



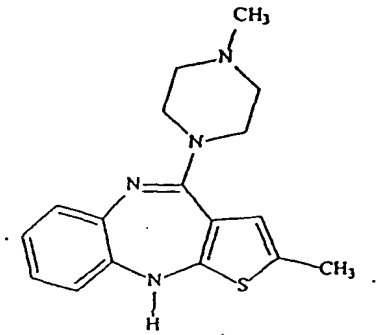
(A)

(57) Abstract: The invention provides three new polymorphic forms of 2-methyl-4-[4-methyl-1-piperazinyl]-10H-thieno[2,3b][1,5]benzodiazepine (Olanzapine) (Formula A), the process for preparing the new polymorphs and pharmaceutical compositions containing the polymorphs. The new polymorphic forms of olanzapine are useful for the treatment of psychotic conditions, mild anxiety and gastrointestinal conditions.

WO 01/47933 A1

NEW POLYMORPHIC FORMS OF OLANZAPINE

This invention relates to novel forms of 2-methyl-4-(4-methyl-1-piperazinyl)-10H-thieno-[2,3b][1,5] benzodiazepine (Formula A), also known as olanzapine. More specifically, the invention provides novel forms of solvate free olanzapine, methods for preparing the novel forms of olanzapine and pharmaceutical formulations containing the novel forms of olanzapine.



A

As described in U.S. Patent No. 5,736,541 (hereinafter "the '541 patent"), the synthesis of olanzapine according to the methods described in U.S. Patent No. 5,229,382 produces a metastable, dull colored product referred to in the '541 patent as "Form I." The '541 patent is herein incorporated by reference in its entirety. The '541 patent discloses and claims a more stable polymorphic form of olanzapine, designated as "Form II", a method to produce "Form II" olanzapine, and pharmaceutical compositions containing "Form II" olanzapine. "Form I" and "Form II" olanzapine are characterized in the '541 patent by powder X-ray diffraction. The interplanar spacings (d-spacings) and typical relative intensities (I/I_1) are reported.

U.S. Patent No. 5,703,232 (hereinafter "the '232 patent") claims lower alcohol solvates of olanzapine referred to in the '232 patent as "Form I" and methods for their preparation. The polymorph designated as "Form I" in the '232 patent has the same characteristic interplanar spacing by X-ray diffraction as "Form II" of the '541 patent and should thus be considered the same polymorph. Similarly, the polymorph designated as "Form II" in the '232 patent has the

same characteristic interplanar spacing by X-ray diffraction as the polymorph designated as "Form I" in the '541 patent and should thus be considered the same polymorph. As used hereinafter the terms "Form I" and "Form II" refer to the olanzapine products designated as "Form I" and "Form II" in the '541 patent having the interplanar spacings and typical relative intensities shown in Table 1.

The present invention satisfies a need for additional stable, anhydrous and solvate-free polymorphic forms of olanzapine useful in the preparation of pharmaceutical formulations.

The present invention provides new polymorphic forms of 2-methyl-4-[4-methyl-1-piperazinyl]-10H-thieno[2,3b][1,5] benzodiazepine (olanzapine) designated as "Form III", "Form IV" and "Form V", methods of preparing the new polymorphic forms of olanzapine and pharmaceutical compositions containing them.

The invention produces new substantially pure polymorphs of olanzapine in high yield. The invention further differs from the prior art by requiring only aqueous solvents to prepare the stable polymorphs. The invention also provides an advantage over the prior art by isolating the new olanzapine polymorphs in a solvent free media, thus producing olanzapine free of solvates and having a negligible solvent content.

The invention provides three novel, solvate free forms of olanzapine designated Form II, Form IV and Form V. The novel forms of olanzapine are characterized by their unique x-ray diffraction patterns and infrared spectra.

The invention further provides a process for preparing the novel forms of olanzapine by first dissolving olanzapine in an aqueous organic or inorganic acid, which may for example be acetic acid, formic acid, hydrochloric acid, sulfuric acid, citric acid, fumaric acid or maleic acid; and is preferably hydrochloric acid, sulfuric acid, formic acid or acetic acid. The new form of olanzapine is then precipitated using an aqueous or alcoholic solution of alkali, which may for example be potassium hydroxide, sodium hydroxide or ammonia. The alcoholic solvent may be any mono, di, or polyhydric alcohol, preferably methanol. The olanzapines obtained typically contain less than 5% of other forms of olanzapine and less than 1% of other impurities. The desired form of olanzapine can be obtained by varying the acid or its concentration, and the temperature and pH

of precipitation. The acid solution used in preparing the novel forms of olanzapine may contain between about 5% and about 50% acid. Olanzapine is preferably precipitated at a temperature between about 0°C and about 100°C, more preferably between about 0°C and about 35°C and most preferably between about 10°C and about 30°C. The final pH of the solution, after precipitation, is preferably between about 6 and about 12, and more preferably between about 8 and about 11.

The invention also provides pharmaceutical formulations containing as an active ingredient at least one of the novel forms of olanzapine according to the invention or a pharmaceutically acceptable salt thereof. The invention further provides a method of treating a psychotic condition, mild anxiety or gastrointestinal conditions by administering an effective amount of at least one of Form III, Form IV or Form V olanzapine or a pharmaceutically acceptable salt thereof to a patient.

The above objectives and advantages of the invention are illustrative, and not exhaustive, of those which can be achieved by the invention and the examples presented herein are non-limiting. Thus, these and other objectives and advantages of the invention will be apparent from the description herein, both as embodied herein and as modified in view of any variations which will be apparent to those skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention are explained in greater detail by way of the accompanying figures:

Figure 1 is a FT-IR spectrum of Form III olanzapine.

Figure 2 is a FT-IR spectrum of Form IV olanzapine.

Figure 3 is a FT-IR spectrum of Form V olanzapine.

Figure 4 is the X-ray diffraction pattern obtained for Form III olanzapine.

Figure 5 is the X-ray diffraction pattern obtained for Form IV olanzapine.

Figure 6 is the X-ray diffraction pattern obtained for Form V olanzapine.

DETAILED DESCRIPTION OF THE INVENTION

The process of the present invention consists of dissolving olanzapine in aqueous acid and precipitating olanzapine from the resultant salt solution using an aqueous or alcoholic

solution of alkali. Alcoholic solutions include any mono-, di- or polyhydric alcohol. A methanolic solution is particularly preferred. The acids to be used in the present invention may be any suitable organic or inorganic acid, for example, hydrochloric acid, sulfuric acid, acetic acid, formic acid, citric acid, fumaric acid, and maleic acid. Other acids include oxalic acid, lactic acid, methane sulphonic acid and hydrobromic acid. Preferred acids are hydrochloric acid, sulfuric acid, acetic acid and formic acid. The concentration of acid may range from 5% to 50%.

Either Form I or Form II olanzapine may be used as a starting material in the invention. The preferred olanzapine used in preparing the novel polymorphs of the invention is Form I olanzapine obtained by the method described in U.S. Patent No. 5,229,382, which is herein incorporated by reference in its entirety.

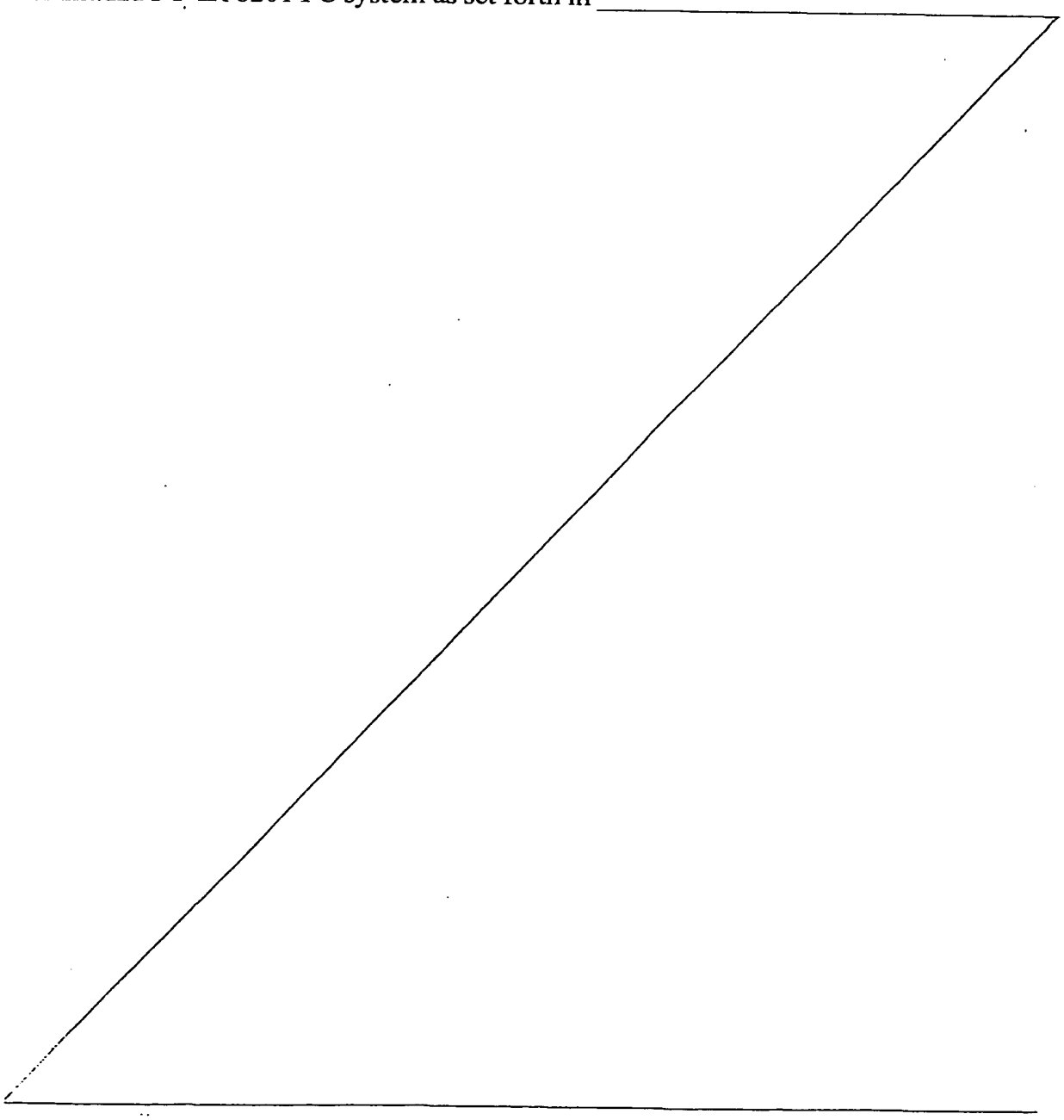
The Form I or Form II olanzapine is mixed with the selected acid and stirred at a suitable temperature until dissolved completely. The solution is then neutralised using a base selected from for example aqueous or alcoholic sodium hydroxide, aqueous or alcoholic potassium hydroxide or aqueous ammonia. Other bases include organic bases such as aqueous monomethyl amine, aqueous dimethylamine and pyridine. Sodium and potassium carbonates and bicarbonates may also be used, although they are not generally preferred owing to effervescence during neutralisation. The alcohol solvent may be any mono, di, or polyhydric alcohol. Methanol is a preferred alcoholic solvent, as is ethanol and isopropanol.

The term "neutralisation" is to be understood in its broadest sense, meaning the addition of base to ensure complete neutralisation of the acid.

The temperature of precipitation is preferably between about 0°C and about 100°C, more preferably between about 0°C and about 35°C and most preferably between about 10°C and about 30°C. During precipitation, the pH of the precipitate is preferably adjusted to be between about 6 and about 12, and more preferably between about 8 and about 11. The novel polymorphs of the invention are obtained in substantially pure form. The term "substantially pure" as used herein means that the polymorphs contain less that 5% of other forms of olanzapine and less than 1% of other impurities, water or solvates.

The novel polymorphs of the invention have been characterized by powder x-ray

diffraction (XRD) patterns obtained using a Shimadzu X-ray diffractometer XRD-6000, equipped with a wide range goniometer and using copper Kα radiation as set forth in Figures 4-6. The interplanar spacings (in Angstroms) and typical relative intensities (I/I_1) sufficient to identify Forms III, IV, and V olanzapine according to the invention are set forth in Table 3. The complete set of interplanar spacings and relative intensities for Forms III, IV, and V olanzapine are set forth in Table 5. The novel polymorphs were further characterized by infrared (IR) spectroscopy obtained in a KBr disk using a Shimadzu FT-IR 8201 PC system as set forth in



Figures 1-3. The IR absorbances (in wavenumbers, cm^{-1}) sufficient to identify Forms III, IV, and V olanzapine are set forth in Table 2. The complete set of IR absorbances for Forms III, IV, and V olanzapine are set forth in Table 4.

Form III olanzapine may be prepared by dissolving Form I or Form II olanzapine in about 50% aqueous acetic acid and precipitating the compound using about 15% aqueous ammonia to a final pH of about 8. Alternatively, Form III olanzapine may be obtained by dissolving Form I or Form II olanzapine in about 33% aqueous acetic acid and precipitating the compound using about 50% aqueous sodium hydroxide to a pH of about 10. Form III olanzapine is characterized by the infrared (IR) spectrum of Figure 1 and by the X-ray diffraction pattern (XRD) of Figure 4. The IR absorbances and XRD peaks sufficient to identify Form III olanzapine are contained in Tables 2 and 3, respectively. The complete set of IR absorbances and XRD peaks for Form III olanzapine are provided in Tables 4 and 5, respectively.

Form IV olanzapine may be prepared by dissolving Form I or Form II olanzapine in about 38% aqueous formic acid and precipitating the compound using about 10% methanolic sodium hydroxide to a final pH of about 8. Alternatively, Form IV olanzapine may be prepared by dissolving Form I or Form II olanzapine in about 43% aqueous acetic acid and precipitating the compound using about 25% ammonia to a final pH of about 10. Form IV olanzapine is characterized by the IR spectrum of Figure 2 and by the XRD of Figure 5. The IR absorbances and XRD peaks sufficient to identify Form IV olanzapine are contained in Tables 2 and 3, respectively. The complete set of IR absorbances and XRD peaks for Form IV olanzapine are provided in Tables 4 and 5, respectively.

Form V olanzapine may be prepared by dissolving Form I or Form II olanzapine in about 10% aqueous hydrochloric acid and precipitating the compound using about 10% aqueous sodium hydroxide to a final pH of about 8.5. Alternatively, Form V olanzapine may be prepared by dissolving Form I or Form II olanzapine in about 40% aqueous acetic acid and precipitating the compound using about 50% aqueous sodium hydroxide to a final pH of about 9. Form V olanzapine may also be obtained by dissolving Form I or Form II olanzapine in about 20% formic acid and precipitating the compound using about 25% aqueous ammonia. Also, Form V olanzapine may be prepared by dissolving Form I or Form II olanzapine in about 50% acetic acid and precipitating the compound using about 25% ammonia to a final pH of about 9. Form V

olanzapine is characterized by the IR spectrum of Figure 3 and by the XRD of Figure 6. The IR absorbances and XRD peaks sufficient to identify Form V olanzapine are contained in Tables 2 and 3, respectively. The complete set of IR absorbances and XRD peaks for Form V olanzapine are provided in Tables 4 and 5, respectively.

The methods of the invention may be used for the purification of olanzapine, as well as for preparation of the new polymorphic forms. For example, 97% pure (by HPLC) Form I olanzapine may be converted to approximately 99% pure Form III olanzapine (HPLC) by dissolving olanzapine in about 33% aqueous acetic acid and precipitating Form III olanzapine using about 50% aqueous sodium hydroxide to a final pH of about 10.

Olanzapine has been found to have a wide range of therapeutic effects, particularly for the treatment of schizophrenia, schizophreniform disorders, psychosis, mild anxiety states and functional bowel disorders. The various disorders which may be treated using olanzapine are described in detail in the '541 patent at column 4, line 62 through column 8, line 55.

Pharmaceutical formulations according to the invention comprise Form III, IV or V olanzapine or a pharmaceutically acceptable salt thereof as an active ingredient together with one or more pharmaceutically acceptable carriers, excipients or diluents. Any conventional technique may be used for the preparation of pharmaceutical formulations according to the invention. Examples of suitable carriers include sugars, starches, gum acacia, calcium phosphate, alginates, tragacanth, gelatin, syrup, methyl cellulose, methyl- and propyl-hydroxy-benzoate, talc, magnesium stearate or mineral oil. The active ingredient may be contained in a formulation that provides quick release, sustained release or delayed release after administration to the patient.

Pharmaceutical compositions may be formulated for transdermal delivery, oral delivery or as a suppository. Formulations may be in the form of capsules, tablets or gels for oral delivery or as a suspension for transermal delivery. Pharmaceutical compositions according to the present invention may preferrably contain 0.25 to 100 mg of active ingredient or, more prefereably, 1 to 30 mg active ingredient, along with a pharmaceutically acceptable carrier.

Methods

Form I olanzapine used as a starting material was obtained by the method described in U.S. Patent No. 5,229,382. IR-Spectra were obtained in a KBr disk using a Shimadzu FT-IR

8201 PC system. The IR-Spectra obtained for the three polymorphic forms, i.e. Forms III, IV, and V, are shown in Figures 1, 2 and 3, respectively. A summary of wavenumbers sufficient to identify Forms III, IV and V olanzapine is provided in Table 2. Table 4 contains a complete listing of IR absorbances for Forms III, IV and V olanzapine according to the invention. Powder x-ray diffraction patterns were obtained on a Shimadzu X-ray diffractometer XRD-6000, equipped with a wide range goniometer using copper Kα radiation. The powder x-ray diffraction patterns for the three polymorphic forms, i.e. Forms III, IV, and V, are provided in Figures 4, 5 and 6, respectively. The interplanar d-spacings sufficient to identify Forms III, IV and V olanzapine and their relative intensities are set forth in Table 3. The complete set of interplanar d-spacings and relative intensities for Forms III, IV and V olanzapine are provided in Table 5.

EXAMPLE 1:

Form I olanzapine (10g) was dissolved in a mixture of 30 ml acetic acid and 30 ml water by stirring. Activated charcoal (0.5 g) was added and the contents filtered over celite. The clear solution was maintained at 20°C and 15% aqueous ammonia solution was added over a period of 30 minutes to adjust the pH to 8. The contents were filtered and dried to obtain Form III olanzapine (9.6g), which was characterized by IR and XRD.

EXAMPLE 2 :

Form I olanzapine (10 g) was dissolved in a mixture of 30 ml acetic acid and 40 ml water and the contents filtered over celite. The clear solution was maintained at 20°C and 30 ml of 25% aqueous ammonia solution was added rapidly in 10 minutes to adjust the pH to about 6. The solids precipitated slowly and the solution was stirred for 30 minutes. A further 30 ml of ammonia solution was added to the mass to obtain a pH of about 10. The contents were further stirred for 1 hour and filtered and dried to obtain Form IV olanzapine (9.4 g), which was charcterized by IR and XRD.

EXAMPLE 3 :

Form I olanzapine (10 g) was disolved in a mixture of 40 ml acetic acid and 60 ml water and the contents filtered over celite. The clear solution was maintained at 20°C and 50 ml of 50% aqueous sodium hydroxide solution was added rapidly with stirring to obtain a gummy

mass. On stirring for a further 30 minutes, a fine suspension was obtained. The pH of the contents was adjusted to about 9 using additional sodium hydroxide solution. The product was recovered by filtration and dried to obain Form V olanzapine (9.4 g), which was characterized by IR and XRD.

EXAMPLE 4 :

Form I olanzapine (10 g) was dissolved in a mixture of 25 ml formic acid and 40 ml water by stirring. Activated charcoal (0.5 g) was added and the contents were filtered over celite. The clear solution was maintained at 10 to 15°C and neutralized with 10% methanolic sodium hydroxide solution to a pH of 8. The product was recovered by filtration and dried to obtain Form IV olanzapine (9.3 g), which was characterized by IR and XRD.

EXAMPLE 5 :

Form I olanzapine (10 g) was dissolved in a mixture of 10 ml formic acid and 40 ml water and the solution was filtered over celite. This solution was added slowly to a stirred 25% aqueous ammonia solution (70 ml) to which a few seed crystals of Form V olanzapine were added. The temperature was maintained between 15 to 25°C during the addition. The contents were stirred for 1 hour and filtered and dried to obtain Form V olanzapine (9.4 g), which was characterized by IR and XRD.

EXAMPLE 6 :

Form I olanzapine (10 g) obtained by the method described in U.S. Patent No. 5,229, 352 and having a purity of 97% (HPLC) was dissolved in a mixture of 30 ml acetic acid and 60 ml water and the solution filtered over celite. The solution was maintained at 20°C with stirring and 50% aqueous sodium hydroxide solution added to adjust the pH to between 6 and 6.2. The solids which precipitated were stirred for 45 minutes and filtered. The wet cake was taken up in water (50 ml) and additional sodium hydroxide added to adjust the pH to 10. The contents were stirred for 1 hour and filtered. The product was dried to obtain >99% pure Form III olanzapine (9.1 g), which was characterized by IR and XRD.

EXAMPLE 7 :

Form I olanzapine (10 g) was dissolved in 50 ml of 10% hydrochloric acid with stirring. Activated charcoal (0.5 g) was added and the contents filtered over celite. The clear solution was maintained at 15°C and neutralized to a pH of 8.5 with 10% aqueous sodium hydroxide solution. The product was recovered by filtration and dried to obtain Form V olanzapine (9.5 g), which was characterized by IR and XRD.

EXAMPLE 8 :

Form I olanzapine (10 g) was dissolved in a mixture of 30 ml acetic acid and 30 ml water and the contents filtered over celite. This solution was added to 60 ml of a stirred 25% aqueous ammonia solution seeded with a few crystals of Form V olanzapine. The temperature was maintained at 15 to 25°C during the addition of the Form I solution to the aqueous ammonia solution and the pH of the mass was 9 after completion of the addition. After stirring for 1 hour, the product was recovered by filtration and dried to obtain Form V olanzapine which was characterized by IR and XRD.

All of the above Examples can be equally well operated using Form II olanzapine as starting material instead of Form I olanzapine.

Certain representative embodiments of the invention are described in the examples given above. The materials used and the process steps are intended as illustrative of the invention and the invention is not limited to the methods, process steps or any other conditions described in the examples. The examples are non-limiting and may be modified or varied, and elements added or omitted, without departing from the invention, as appreciated by those skilled in the art.

TABLE - 1

X-RAY DIFFRACTION PEAKS OF FORM I AND FORM II OLANZAPINE

SUMMARY OF d-spacing AND I/I_1 INTENSITY RATIO

FORM I		FORM II	
d-spacing	I/I_1	d-spacing	I/I_1
9.9463	100.00	10.2689	100.00
8.5579	15.18	8.577	7.96
8.2445	1.96	7.4721	1.41
6.8862	14.73	7.125	6.50
6.3787	4.25	6.1459	3.12
6.2439	5.21	6.071	5.12
5.5895	1.10	5.4849	0.52
5.3055	0.95	5.2181	6.86
4.9815	6.14	5.1251	2.47
4.8333	68.37	4.9874	7.41
4.7255	21.88	4.7665	4.03
4.6286	3.82	4.7158	6.80
4.533	17.83	4.4787	14.72
4.4624	5.02	4.3307	1.48
4.2915	9.19	4.2294	23.19
4.2346	18.88	4.141	11.28
4.0855	17.29	3.9873	9.01
3.8254	6.49	3.7206	14.04
3.7489	10.64	3.5645	2.27
3.6983	14.65	3.5366	4.85
3.5817	3.04	3.3828	3.47
3.5064	9.23	3.2516	1.25
3.3392	4.67	3.134	0.81
3.2806	1.96	3.0848	0.45
3.2138	2.52	3.0638	1.34
3.1118	4.81	3.0111	3.51
3.0507	1.96	2.8739	0.79
2.948	2.40	2.8102	1.47
2.8172	2.89	2.7217	0.20
2.7589	2.27	2.6432	1.26
2.6597	1.86	2.6007	0.77
2.6336	1.10		
2.5956	1.73		

TABLE - 2

FT-IR PEAKS OF FORM III, FORM IV AND FORM V OLANZAPINE

SUMMARY OF WAVENUMBERS

FORM-III	FORM-IV	FORM-V
cm^{-1}	cm^{-1}	cm^{-1}
-	604	604
611	-	-
656	661	-
671	-	671
746	-	746
765	758	758
845	-	847
-	904	-
935	931	928
-	-	1357
1369	1365	1369
-	1456	-

TABLE - 3

X-RAY DIFFRACTION PEAKS OF FORM III, FORM IV AND FORM V OLANZAPINE

SUMMARY OF d-spacing AND I/I_1 INTENSITY RATIO

FORM-III			FORM-IV			FORM-V		
2-theta [deg.]	d-spacing	I/I_1	2-theta [deg.]	d-spacing	I/I_1	2-theta [deg.]	d-spacing	I/I_1
8.5649	10.3156	100	8.8814	9.9487	83	8.3400	10.5932	17
12.3325	7.1713	16	10.3898	8.5074	15	8.6477	10.2170	100
13.6091	6.5014	17	10.7669	8.2103	17	8.8800	9.9503	57
16.0535	5.5165	24	18.4029	4.8172	100	10.3673	8.5259	22
18.2617	4.8541	46	18.8200	4.7114	41	12.4540	7.1016	17
19.4600	4.5578	24	19.2284	4.6122	35	14.5737	6.0731	17
19.7400	4.4938	38	19.5884	4.5282	33	17.0243	5.2041	19
19.9200	4.4536	36	20.9646	4.2340	29	17.7763	4.9856	20
20.8409	4.2588	49	21.7109	4.0901	32	18.4102	4.8153	62
22.2635	3.9898	52	23.6600	3.7574	23	18.6600	4.7514	34
23.8442	3.7288	42	24.0400	3.6989	40	19.5800	4.5302	24
24.9738	3.5626	25				19.8400	4.4714	51
29.4932	3.0262	18				20.9993	4.2271	91
						21.4949	4.1307	40
						22.2738	3.9880	31
						23.5400	3.7763	10
						23.9232	3.7167	62
						25.1975	3.5315	22

TABLE - 4

COMPLETE FT-IR PEAKS OF

FORM III, FORM IV AND FORM V OLANZAPINE

SUMMARY OF WAVENUMBERS

FORM-III	FORM-IV	FORM-V
cm^{-1}	cm^{-1}	cm^{-1}
-	604	604
611	-	-
656	661	-
671	-	671
746	-	746
765	758	758
845	-	847
-	904	-
935	931	928
966	970	966
1008	1005	1006
1348	1344	1344
-	-	1357
1369	1365	1369
1414	1419	1414
-	1456	1414
-	1456	-
1469	1469	1469
1560	1560	1560
1593	1589	1585
2790	2798	2792
2837	2842	2839
2933	2927	2931
3232	3234	3228

TABLE - 5

COMPLETE X-RAY DIFFRACTION PEAKS OF FORM III, FORM IV AND FORM V OLANZAPINE

SUMMARY OF d-spacing AND I/I_1 INTENSITY RATIO

FORM-III			FORM-IV			FORM-V		
2-theta [deg.]	d-spacing	I/I_1	2-theta [deg.]	d-spacing	I/I_1	2-theta [deg.]	d-spacing	I/I_1
8.22	10.7476	15	8.88	9.9487	83	8.34	10.5932	17
8.56	10.3156	100	10.39	8.5074	15	8.65	10.2170	100
10.25	8.6245	11	10.77	8.2103	17	8.88	9.9503	57
12.33	7.1713	16	12.88	6.8673	12	10.37	8.5259	22
13.61	6.5014	17	17.82	4.9734	12	12.45	7.1016	17
14.48	6.1120	14	18.40	4.8172	100	14.57	6.0731	17
14.94	5.9251	12	18.82	4.7114	41	17.02	5.2041	19
15.20	5.8243	12	19.23	4.6122	35	17.78	4.9856	20
16.05	5.5165	24	19.59	4.5282	33	18.41	4.8153	62
16.92	5.2359	11	20.96	4.2340	29	18.66	4.7514	34
18.26	4.8541	46	21.71	4.0901	32	19.22	4.6139	15
18.66	4.7514	10	23.66	3.7574	23	19.58	4.5302	24
19.46	4.5578	24	24.04	3.6989	40	19.84	4.4714	51
19.74	4.4938	38	25.39	3.5052	11	20.99	4.2271	91
19.92	4.4536	36				21.49	4.1307	40
20.84	4.2588	49				21.80	4.0736	15
21.38	4.1523	30				22.27	3.9880	31
21.82	4.0699	15				23.54	3.7763	10
22.26	3.9898	52				23.92	3.7167	62
22.81	3.8955	10				25.20	3.5315	22
23.84	3.7288	42				26.38	3.3762	13
24.97	3.5626	25				29.70	3.0060	11
29.49	3.0262	18						

CLAIMS:

1. A process for producing a polymorph of olanzapine comprising:

dissolving an initial polymorph of olanzapine in aqueous acidic solution; wherein the aqueous acidic solution comprises an acid selected from the group consisting of organic and inorganic acids; and

precipitating a different polymorph of olanzapine by neutralisation; wherein neutralisation is accomplished by the addition of an aqueous or alcoholic solution of a base.

2. A process according to claim 1, wherein the acid is selected from the group consisting of hydrochloric acid, sulfuric acid, acetic acid, formic acid, citric acid, fumaric acid and maleic acid.

3. A process according to claim 1 or 2, wherein the acid is selected from the group consisting of hydrochloric acid, sulfuric acid, acetic acid and formic acid.

4. A process according to claim 1, 2 or 3, wherein the solution of the base is selected from the group consisting of aqueous sodium hydroxide, alcoholic sodium hydroxide, aqueous potassium hydroxide, alcoholic potassium hydroxide and aqueous ammonia.

5. A process according to claim 1, 2, 3 or 4, wherein the alcoholic solution of the base comprises an alcohol selected from a mono, di, or polyhydric alcohol.

6. A process according to claim 5, wherein the alcohol is methanol.

7. A process according to any of claims 1 to 6, further comprising the step of :

recovering said different polymorph of olanzapine containing less than 5% of the initial form of olanzapine and less than 1% of other impurities.

8. A process according to any of claims 1 to 7, wherein the initial polymorph of olanzapine is Form I or Form II olanzapine, wherein Form I olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
9.9463
8.5579
8.2445
6.8862
6.3787
6.2439
5.5895
5.3055
4.9815
4.8333
4.7255
4.6286
4.533
4.4624
4.2915
4.2346
4.0855
3.8254
3.7489
3.6983
3.5817
3.5064
3.3392
3.2806
3.2138
3.1118

3.0507

2.948

2.8172

2.7589

2.6597

2.6336

2.5956;

and Form II olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
10.2689
8.577
7.4721
7.125
6.1459
6.071
5.4849
5.2181
5.1251
4.9874
4.7665
4.7158
4.4787
4.3307
4.2294
4.141
3.9873
3.7206
3.5645
3.5366

3.3828

3.2516

3.134

3.0848

3.0638

3.0111

2.8739

2.8102

2.7217

2.6432

2.6007.

9. A process according to any of claims 1 to 8, wherein the different polymorph of olanzapine is Form III olanzapine having a typical x-ray powder diffraction pattern as represented by the following interplanar spacings:

d-spacing (Å)
10.3156
7.1713
6.5014
5.5165
4.8541
4.5578
4.4938
4.4536
4.2588
3.9898
3.7288
3.5626
3.0262.

10. A process according to any of claims 1 to 8, wherein the different polymorph of olanzapine is Form IV olanzapine having a typical x-ray powder diffraction pattern as represented by the following interplanar spacings:

d-spacings (Å)
9.9487
8.5074
8.2103
4.8172
4.7114
4.6122
4.5282
4.2340
4.0901
3.7574
3.6989

11. A process according to any of claims 1 to 8, wherein the different polymorph of olanzapine is Form V olanzapine having a typical x-ray powder diffraction pattern as represented by the following interplanar spacings:

d-spacing (Å)
10.5932
10.2170
9.9503
8.5259
7.1016
6.0731
5.2041
4.9856
4.8153
4.7514
4.5302

4.4714
4.2271
4.1307
3.9880
3.7763
3.7167
3.5315.

12. A process according to any preceding claim, wherein the precipitation is conducted at a temperature between about 0°C and about 100°C.

13. A process according to any preceding claim, wherein the precipitation is conducted at a temperature between about 0°C and about 35°C.

14. A process according to any preceding claim, wherein the precipitation is conducted at a temperature between about 10°C and about 30°C.

15. A process according to any preceding claim, wherein the precipitation comprises adjusting the pH to between about 6 and about 12.

16. A process according to any preceding claim, wherein the precipitation comprises adjusting the pH to between about 8 and about 11.

17. A process according to any preceding claim, wherein the acidic solution comprises from about 5% to about 50% acid.

18. A process according to any preceding claim, wherein the acidic solution is about 50% acetic acid and the basic solution is about 15% aqueous ammonia.

19. A process according to any of claims 1-17, wherein the acidic solution is about 38% formic acid and the basic solution is about 10% methanolic sodium hydroxide.

20. A process according to any of claims 1-17, wherein the acidic solution is about 10% hydrochloric acid and the basic solution is about 10% aqueous sodium hydroxide.

21. A process according to any of claims 1-17, wherein the acidic solution is about 43% acetic acid and the basic solution is about 25% aqueous ammonia.

22. A process according to any of claims 1-17, wherein the acidic solution is about 40% acetic acid and the basic solution is about 50% aqueous sodium hydroxide.

23. A process according to any of claims 1-17, wherein the acidic solution is about 20% formic acid and the basic solution is about 25% aqueous ammonia.

24. A process according to any of claims 1-17, wherein the acidic solution is about 33% acetic acid and the basic solution is about 50% aqueous ammonia.

25. A process according to any of claims 1-17, wherein the acidic solution is about 50% acetic acid and the basic solution is about 25% aqueous ammonia.

26. Form III olanzapine polymorph having a typical x-ray powder diffraction pattern as represented by the following interplanar spacings:

d-spacing (Å)
10.3156
7.1713
6.5014
5.5165
4.8541
4.5578

4.4938
4.4536
4.2588
4.0699
3.9898
3.7288
3.5626
3.0262.

27. Form III olanzapine polymorph according claim 26, further characterized by substantially the following x-ray powder diffraction pattern, wherein d represents the interplanar spacing and I/I_1 represents the typical relative intensities:

d-spacing (Å)	I/I_1
10.3156	100
7.1713	16
6.5014	17
5.5165	24
4.8541	46
4.5578	24
4.4938	38
4.4536	36
4.2588	49
3.9898	52
3.7288	42
3.5626	25
3.0262	18.

28. Form III olanzapine polymorph according to claim 26 or 27, further characterized by having an infrared spectrum having absorbances at the following wavenumbers:

611
656

671

746

765

845

935

1369.

29. Form III olanzapine polymorph according to claim 26, 27 or 28 produced by the process of:

dissolving Form I or Form II olanzapine in 50% aqueous acetic acid, and

precipitating substantially pure Form III olanzapine with 15% aqueous ammonia;

wherein Form I olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
9.9463
8.5579
8.2445
6.8862
6.3787
6.2439
5.5895
5.3055
4.9815
4.8333
4.7255
4.6286
4.533
4.4624
4.2915
4.2346
4.0855
3.8254

3.7489

3.6983

3.5817

3.5064

3.3392

3.2806

3.2138

3.1118

3.0507

2.948

2.8172

2.7589

2.6597

2.6336

2.5956;

and Form II olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
10.2689
8.577
7.4721
7.125
6.1459
6.071
5.4849
5.2181
5.1251
4.9874
4.7665
4.7158
4.4787

4.3307

4.2294

4.141

3.9873

3.7206

3.5645

3.5366

3.3828

3.2516

3.134

3.0848

3.0638

3.0111

2.8739

2.8102

2.7217

2.6432

2.6007.

30. Form III olanzapine polymorph according to claim 26, 27 or 28 produced by the process of:

dissolving Form I or Form II olanzapine in about 33% aqueous acetic acid, and

precipitating substantially pure Form III olanzapine with about 50% aqueous ammonia;

wherein Form I olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
9.9463
8.5579
8.2445
6.8862
6.3787
6.2439

5.5895

5.3055

4.9815

4.8333

4.7255

4.6286

4.533

4.4624

4.2915

4.2346

4.0855

3.8254

3.7489

3.6983

3.5817

3.5064

3.3392

3.2806

3.2138

3.1118

3.0507

2.948

2.8172

2.7589

2.6597

2.6336

2.5956;

and Form II olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
10.2689

8.577

7.4721

7.125

6.1459

6.071

5.4849

5.2181

5.1251

4.9874

4.7665

4.7158

4.4787

4.3307

4.2294

4.141

3.9873

3.7206

3.5645

3.5366

3.3828

3.2516

3.134

3.0848

3.0638

3.0111

2.8739

2.8102

2.7217

2.6432

2.6007.

31. Form IV olanzapine polymorph having a typical x-ray powder diffraction pattern as represented by the following interplanar spacings:

d-spacing (Å)
9.9487
8.5074
8.2103
4.8172
4.7114
4.6122
4.5282
4.2340
4.0901
3.7574
3.6989.

32. Form IV olanzapine polymorph according to claim 31, further characterized by substantially the following x-ray powder diffraction pattern, wherein d represents the interplanar spacing and I/I_1 represents the typical relative intensities:

d-spacing (Å)	I/I_1
9.9487	83
8.5074	15
8.2103	17
4.8172	100
4.7114	41
4.6122	35
4.5282	33
4.2340	29
4.0901	32
3.7574	23
3.6989	40

33. Form IV olanzapine polymorph according to claim 31 or 32 further characterized by having an infrared spectum having absorbances at the following wavenumbers:

604

661

758

904

931

1365

1456.

34. Form IV olanzapine polymorph according to claim 31, 32 or 33, produced by the process of:

dissolving Form I or Form II olanzapine in about 38% aqueous formic acid, and

precipitating substantially pure Form IV olanzapine using about 10% methanolic sodium hydroxide;

wherein Form I olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
9.9463
8.5579
8.2445
6.8862
6.3787
6.2439
5.5895
5.3055
4.9815
4.8333
4.7255
4.6286
4.533
4.4624

4.2915
4.2346
4.0855
3.8254
3.7489
3.6983
3.5817
3.5064
3.3392
3.2806
3.2138
3.1118
3.0507
2.948
2.8172
2.7589
2.6597
2.6336
2.5956;

and Form II olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
10.2689
8.577
7.4721
7.125
6.1459
6.071
5.4849
5.2181
5.1251

4.9874

4.7665

4.7158

4.4787

4.3307

4.2294

4.141

3.9873

3.7206

3.5645

3.5366

3.3828

3.2516

3.134

3.0848

3.0638

3.0111

2.8739

2.8102

2.7217

2.6432

2.6007.

35. Form IV olanzapine polymorph according to claim 31, 32 or 33, produced by the process of:

dissolving Form I or Form II olanzapine in about 43% aqueous acetic acid, and

precipitating substantially pure Form IV olanzapine using about 25% aqueous ammonia;

wherein Form I olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
9.9463
8.5579

8.2445

6.8862

6.3787

6.2439

5.5895

5.3055

4.9815

4.8333

4.7255

4.6286

4.533

4.4624

4.2915

4.2346

4.0855

3.8254

3.7489

3.6983

3.5817

3.5064

3.3392

3.2806

3.2138

3.1118

3.0507

2.948

2.8172

2.7589

2.6597

2.6336

2.5956;

and Form II olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
10.2689
8.577
7.4721
7.125
6.1459
6.071
5.4849
5.2181
5.1251
4.9874
4.7665
4.7158
4.4787
4.3307
4.2294
4.141
3.9873
3.7206
3.5645
3.5366
3.3828
3.2516
3.134
3.0848
3.0638
3.0111
2.8739
2.8102

2.7217

2.6432

2.6007.

36. Form V olanzapine polymorph having a typical x-ray powder diffraction pattern as represented by the following interplanar spacings:

d-spacing (Å)
10.5932
10.2170
9.9503
8.5259
7.1016
6.0731
5.2041
4.9856
4.8153
4.7514
4.5302
4.4714
4.2271
4.1307
3.9880
3.7763
3.7167
3.5315.

37. Form V olanzapine polymorph according to claim 36, further characterized by substantially the following x-ray powder diffraction pattern, wherein d represents the interplanar spacing and I/I_1 represents the typical relative intensities:

d-spacing (Å)	I/I_1
10.5932	17

10.2170	100
9.9503	57
8.5259	22
7.1016	17
6.0731	17
5.2041	19
4.9856	20
4.8153	62
4.7514	34
4.5302	24
4.4714	51
4.2271	91
4.1307	40
3.9880	31
3.7763	10
3.7167	62
3.5315	22

38. Form V olanzapine polymorph according to claim 36 or 37, further characterized by having an infrared spectum having absorbances at the following wavenumbers:

604
671
746
758
847
928
1357
1369.

39. Form V olanzapine polymorph according to claim 36, 37 or 38, produced by the process of: dissolving Form I or Form II olanzapine in about 10% aqueous hydrochloric acid, and

precipitating substantially pure Form V olanzapine using about 10% aqueous sodium hydroxide;

wherein Form I olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
9.9463
8.5579
8.2445
6.8862
6.3787
6.2439
5.5895
5.3055
4.9815
4.8333
4.7255
4.6286
4.533
4.4624
4.2915
4.2346
4.0855
3.8254
3.7489
3.6983
3.5817
3.5064
3.3392
3.2806
3.2138
3.1118

3.0507
2.948
2.8172
2.7589
2.6597
2.6336
2.5956;

and Form II olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
10.2689
8.577
7.4721
7.125
6.1459
6.071
5.4849
5.2181
5.1251
4.9874
4.7665
4.7158
4.4787
4.3307
4.2294
4.141
3.9873
3.7206
3.5645
3.5366

3.3828
3.2516
3.134
3.0848
3.0638
3.0111
2.8739
2.8102
2.7217
2.6432
2.6007.

40. Form V olanzapine polymorph according to claim 36, 37 or 38, produced by the process of:

dissolving Form I or Form II olanzapine in about 40% acetic acid, and

precipitating substantially pure Form V olanzapine using about 50% aqueous sodium hydroxide;

wherein Form I olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
9.9463
8.5579
8.2445
6.8862
6.3787
6.2439
5.5895
5.3055
4.9815
4.8333
4.7255
4.6286

4.533
4.4624
4.2915
4.2346
4.0855
3.8254
3.7489
3.6983
3.5817
3.5064
3.3392
3.2806
3.2138
3.1118
3.0507
2.948
2.8172
2.7589
2.6597
2.6336
2.5956;

and Form II olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
10.2689
8.577
7.4721
7.125
6.1459
6.071
5.4849

5.2181
5.1251
4.9874
4.7665
4.7158
4.4787
4.3307
4.2294
4.141
3.9873
3.7206
3.5645
3.5366
3.3828
3.2516
3.134
3.0848
3.0638
3.0111
2.8739
2.8102
2.7217
2.6432
2.6007.

41 Form V olanzapine polymorph according to claim 36, 37 or 38, produced by the process of:

dissolving Form I or Form II olanzapine in about 20% aqueous formic acid, and

precipitating substantially pure Form V olanzapine using about 25% aqueous ammonia;

wherein Form I olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
9.9463
8.5579
8.2445
6.8862
6.3787
6.2439
5.5895
5.3055
4.9815
4.8333
4.7255
4.6286
4.533
4.4624
4.2915
4.2346
4.0855
3.8254
3.7489
3.6983
3.5817
3.5064
3.3392
3.2806
3.2138
3.1118
3.0507
2.948
2.8172
2.7589

2.6597

2.6336

2.5956;

and Form II olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
10.2689
8.577
7.4721
7.125
6.1459
6.071
5.4849
5.2181
5.1251
4.9874
4.7665
4.7158
4.4787
4.3307
4.2294
4.141
3.9873
3.7206
3.5645
3.5366
3.3828
3.2516
3.134
3.0848
3.0638

3.0111
2.8739
2.8102
2.7217
2.6432
2.6007.

42. Form V olanzapine polymorph according to claim 36, 37 or 38, produced by the process of:

dissolving Form I or Form II olanzapine in about 50% aqueous acetic acid, and

precipitating substantially pure Form V olanzapine using about 25% aqueous ammonia;

wherein Form I olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
9.9463
8.5579
8.2445
6.8862
6.3787
6.2439
5.5895
5.3055
4.9815
4.8333
4.7255
4.6286
4.533
4.4624
4.2915
4.2346
4.0855
3.8254

3.7489
3.6983
3.5817
3.5064
3.3392
3.2806
3.2138
3.1118
3.0507
2.948
2.8172
2.7589
2.6597
2.6336
2.5956;

and Form II olanzapine is an olanzapine polymorph having a typical x-ray powder diffraction pattern represented by the following interplanar spacings:

d-spacings (Å)
10.2689
8.577
7.4721
7.125
6.1459
6.071
5.4849
5.2181
5.1251
4.9874
4.7665
4.7158
4.4787

4.3307

4.2294

4.141

3.9873

3.7206

3.5645

3.5366

3.3828

3.2516

3.134

3.0848

3.0638

3.0111

2.8739

2.8102

2.7217

2.6432

2.6007.

43. A pharmaceutical formulation containing as an active ingredient at least one olanzapine polymorph associated with one or more pharmaceutically acceptable carriers, excipients or diluents therefor; wherein the at least one olanzapine polymorph is Form III olanzapine, Form IV olanzapine or Form V olanzapine, and salts and mixtures thereof; and wherein Forms III, IV and V olanzapine are olanzapine polymorphs having typical x-ray powder diffraction patterns represented by the following interplanar spacings:

FORM-III	FORM-IV	FORM IV
d-spacing (Å)	d-spacing (Å)	d-spacing (Å)
10.3156	9.9487	10.5932
7.1713	8.5074	10.2170
6.5014	8.2103	9.9503

5.5165	4.8172	8.5259
4.8541	4.7114	7.1016
4.5578	4.6122	6.0731
4.4938	4.5282	5.2041
4.4536	4.2340	4.9856
4.2588	4.0901	4.8153
3.9898	3.7574	4.7514
3.7288	3.6989	4.5302
3.5626		4.4714
3.0262		4.2271
		4.1307
		3.9880
		3.7763
		3.7167
		3.5315

44. A method of treating a condition selected from the group consisting of a psychotic condition, mild anxiety and gastrointestinal conditions comprising administering an effective amount of at least one olanzapine polymorph to a patient in need thereof; wherein the at least one olanzapine polymorph is selected from the group consisting of Form III olanzapine, Form IV olanzapine, Form V olanzapine, and salts and mixtures thereof; and wherein Forms III, IV and V olanzapine are olanzapine polymorphs having typical x-ray powder diffraction patterns represented by the following interplanar spacings:

FORM-III	FORM-IV	FORM IV
d-spacing (Å)	d-spacing (Å)	d-spacing (Å)
10.3156	9.9487	10.5932
7.1713	8.5074	10.2170
6.5014	8.2103	9.9503
5.5165	4.8172	8.5259

4.8541	4.7114	7.1016
4.5578	4.6122	6.0731
4.4938	4.5282	5.2041
4.4536	4.2340	4.9856
4.2588	4.0901	4.8153
3.9898	3.7574	4.7514
3.7288	3.6989	4.5302
3.5626		4.4714
3.0262		4.2271
		4.1307
		3.9880
		3.7763
		3.7167
		3.5315

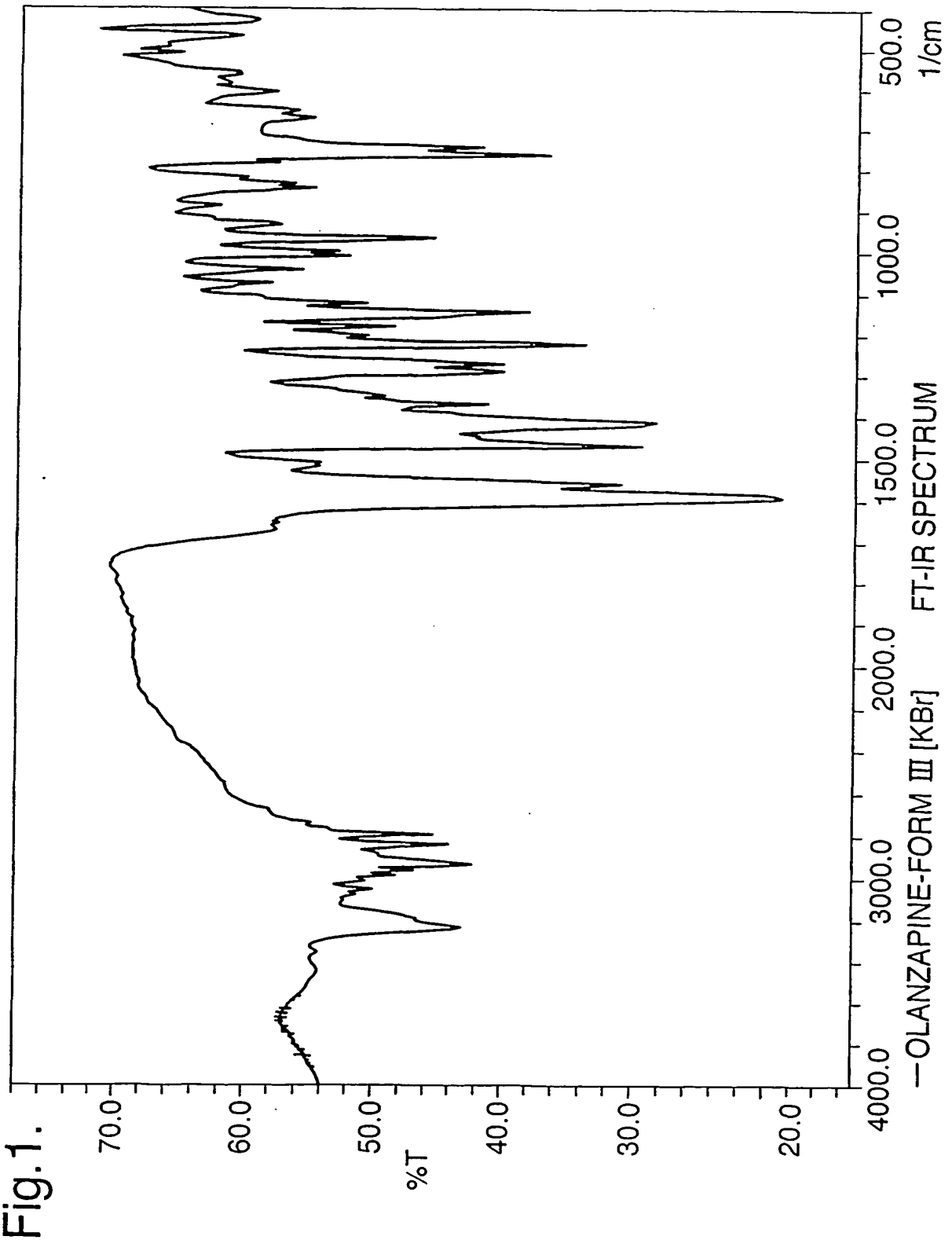


Fig. 1.

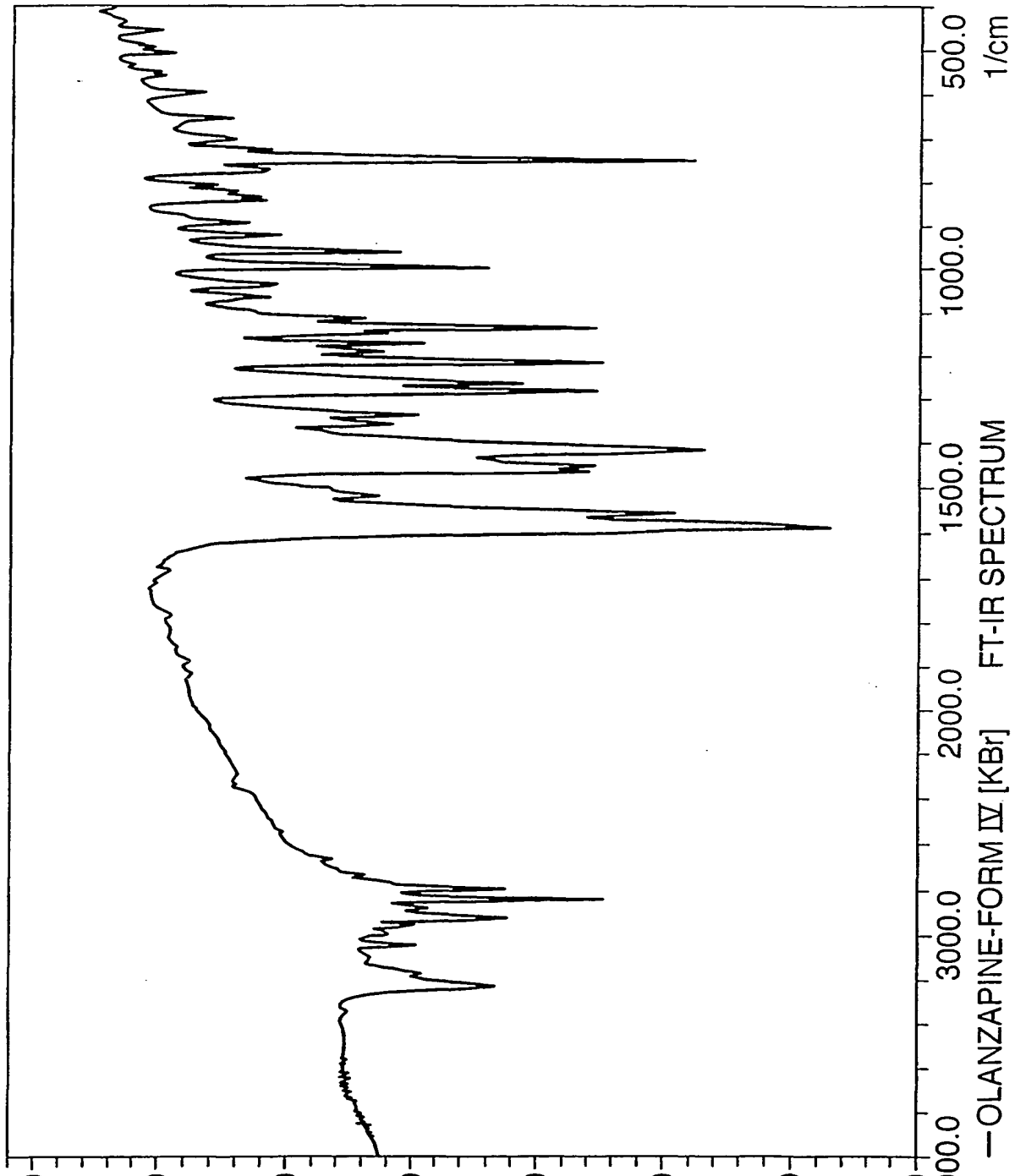


Fig.2.

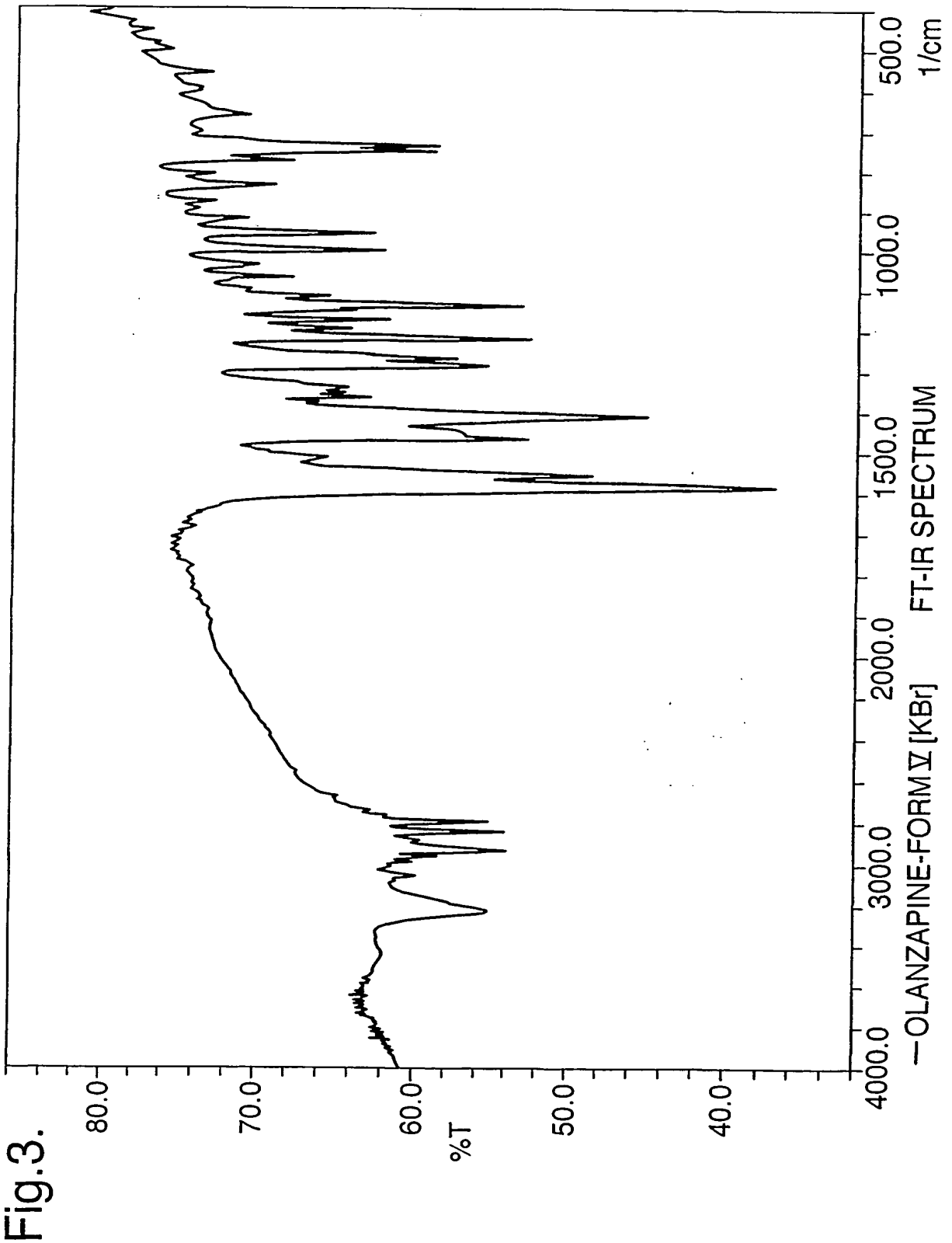


Fig.3.

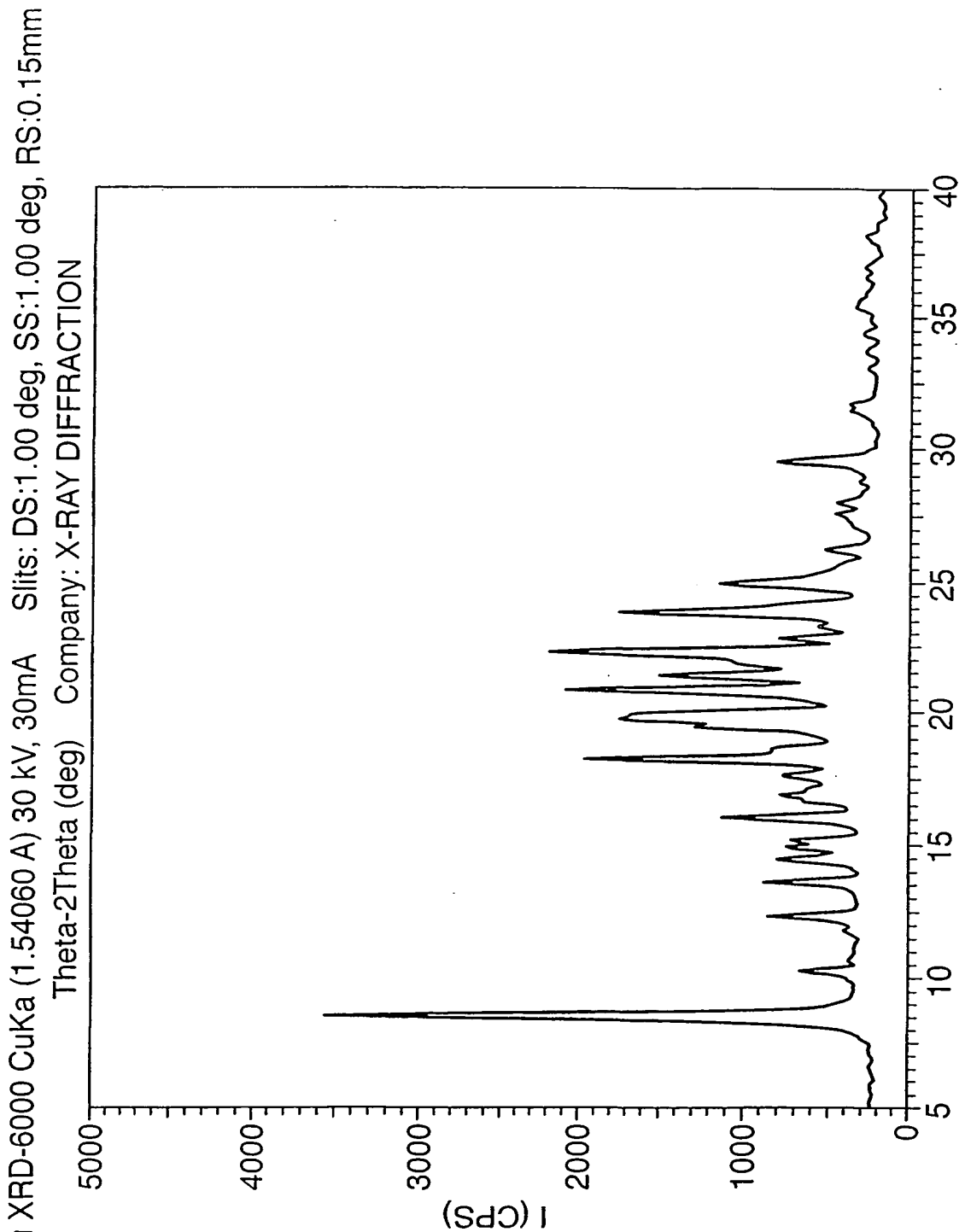

Shimadzu XRD-6000 CuKa (1.54060 A) 30 kV, 30mA Slits: DS:1.00 deg, SS:1.00 deg, RS:0.15mm
Theta-2Theta (deg) Company: X-RAY DIFFRACTION
I (CPS)
5000
4000
3000
2000
1000
0
5
10
15
20
25
30
35
40
Theta-2Theta (deg)
Cont.Scan 2.0 deg/min 0.60 sec 0.020 deg.
X-RAY DIFFRACTION PATTERN-FORM III

Fig.4.

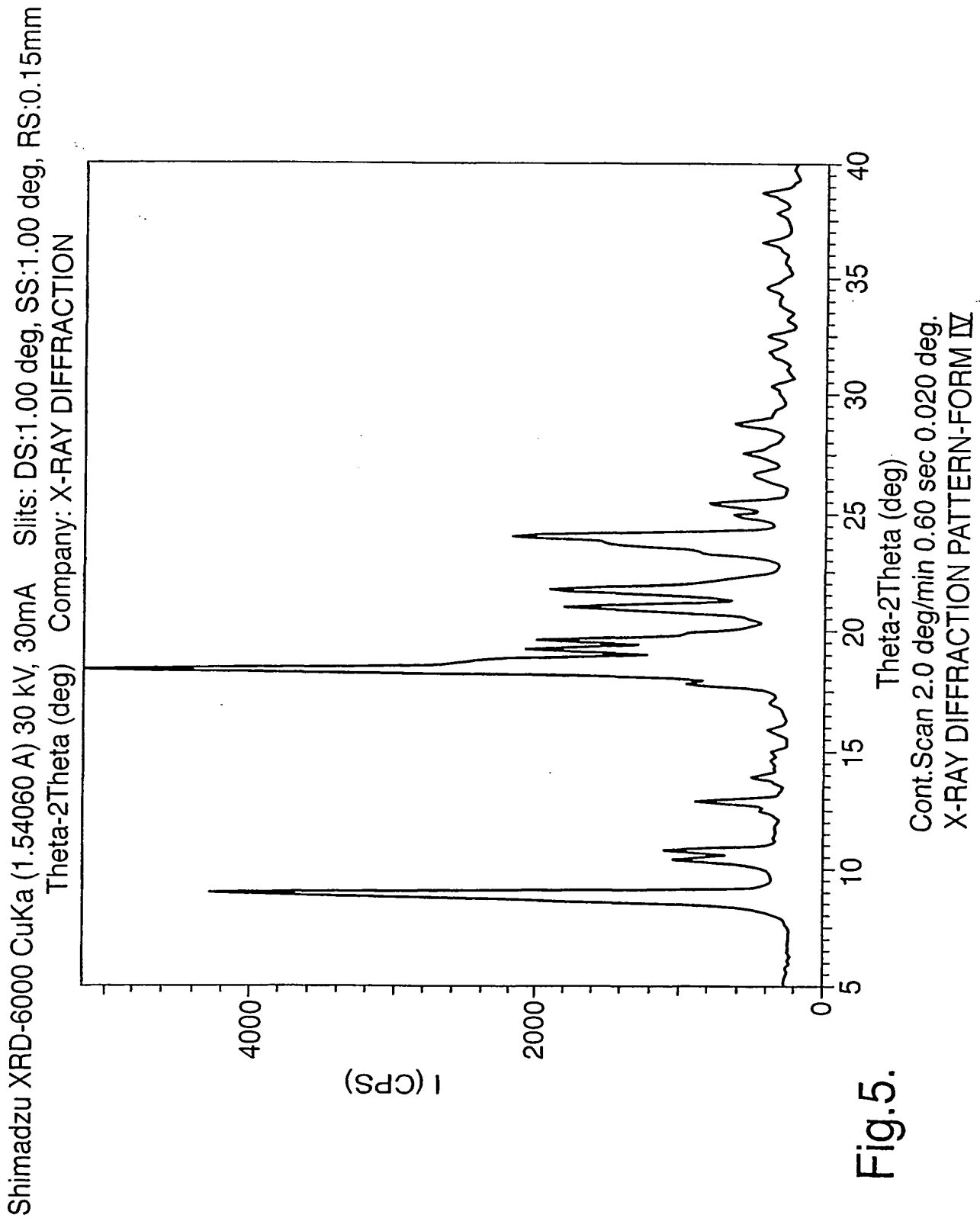


Fig.5.

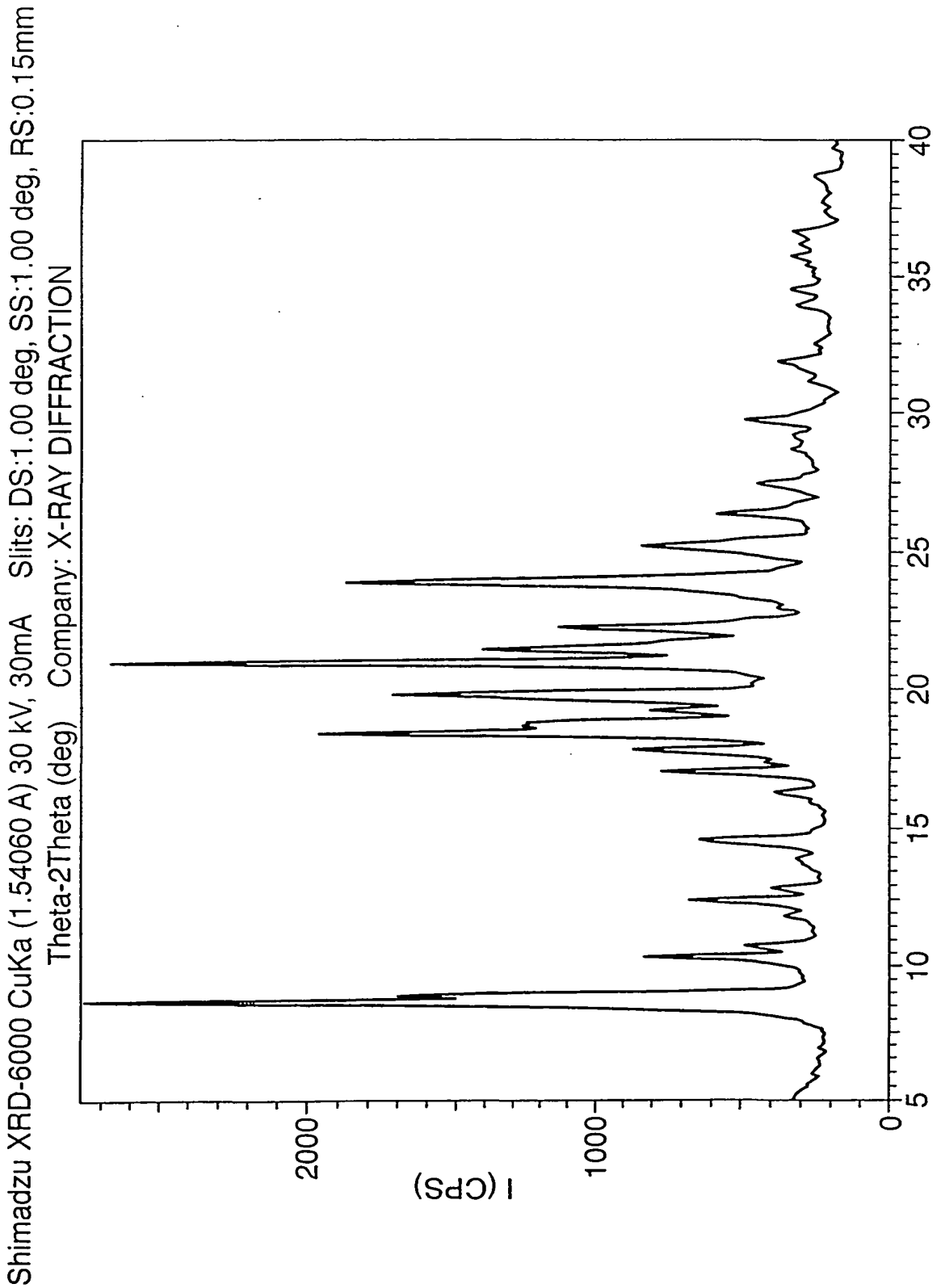

Shimadzu XRD-6000 CuKa (1.54060 A) 30 kV, 30mA Slits: DS:1.00 deg, SS:1.00 deg, RS:0.15mm
Theta-2Theta (deg) Company: X-RAY DIFFRACTION
I (CPS)
2000
1000
0
5
10
15
20
25
30
35
40
Theta-2Theta (deg)
Cont.Scan 2.0 deg/min 0.60 sec 0.020 deg.
X-RAY DIFFRACTION PATTERN-FORM V

Fig.6.

INTERNATIONAL SEARCH REPORT

Inte pplication No
PCT/GB 00/04982

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C07D495/04 A61K31/55 A61P25/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C07D A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
CHEM ABS Data, EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 831 097 A (LILLY CO ELI) 25 March 1998 (1998-03-25) page 1 -page 8 ---	1-25
X	EP 0 733 635 A (LILLY, ELI, AND CO., USA;LILLY INDUSTRIES LTD.) 25 September 1996 (1996-09-25) cited in the application page 2, line 11 - line 14 ---	1-44
Y	HOUBEN-WEYL: "Methoden der organischen Chemie, Band I/1, Allgemeine Laboratoriumspraxis I" 1958 , GEORG THIEME VERLAG , STUTTGART XP002163768 page 381 -page 382 --- -/--	1-25

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 March 2001	29/04/01

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Grassi, D

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 919 485 A (MORRIS TOMMY CLIFFORD ET AL) 6 July 1999 (1999-07-06) column 2, line 29 - line 32	1-44
P,Y	WO 00 18408 A (LILLY CO ELI) 6 April 2000 (2000-04-06) the whole document	1-44

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 00/04982

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

Although claim 44 is directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.

2. [ ] Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB 00/04982

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0831097 A	25-03-1998	AU 720366 B	01-06-2000
		AU 4424197 A	14-04-1998
		BR 9711541 A	24-08-1999
		CN 1234738 A	10-11-1999
		CZ 9900989 A	11-08-1999
		HU 0000065 A	28-06-2000
		JP 2001500878 T	23-01-2001
		NO 991339 A	19-03-1999
		PL 332541 A	13-09-1999
		TR 9900639 T	21-06-1999
		WO 9811893 A	26-03-1998
		ZA 9708512 A	23-03-1999
EP 0733635 A	25-09-1996	AP 828 A	28-04-2000
		AT 406771 B	25-08-2000
		AT 902196 A	15-01-2000
		AT 197711 T	15-12-2000
		AU 5257896 A	16-10-1996
		AU 706471 B	17-06-1999
		AU 5427996 A	16-10-1996
		BG 62619 B	31-03-2000
		BG 101900 A	31-03-1999
		BR 9607790 A	07-07-1998
		CA 2214005 A	03-10-1996
		CH 690579 A	31-10-2000
		CZ 9703000 A	17-12-1997
		DE 19681286 T	02-04-1998
		DE 69611003 D	28-12-2000
		DK 108997 A	12-11-1997
		EP 0733634 A	25-09-1996
		ES 2151991 T	16-01-2001
		FI 973750 A	22-09-1997
		GB 2313835 A,B	10-12-1997
		HU 9802824 A	28-06-1999
		JP 11502535 T	02-03-1999
		LT 97148 A,B	26-01-1998
		LU 90096 A	22-07-1997
		LV 12018 A	20-04-1998
		LV 12018 B	20-09-1998
		NO 974365 A	22-09-1997
		NZ 306110 A	24-09-1998
		PL 322501 A	02-02-1998
		SE 9703205 A	05-09-1997
		SI 9620040 A	30-06-1998
		SK 121897 A	04-03-1998
		TR 9701017 T	21-01-1998
		WO 9630374 A	03-10-1996
		WO 9630375 A	03-10-1996
		US 5736541 A	07-04-1998
US 5919485 A	06-07-1999	AP 679 A	28-09-1998
		AT 405606 B	25-10-1999
		AT 902296 A	15-02-1999
		AU 696601 B	17-09-1998
		AU 5428096 A	16-10-1996
		BG 62594 B	31-03-2000
		BG 101901 A	30-10-1998
		BR 9607791 A	07-07-1998

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inten[illegible]pplication No
PCT/GB 00/04982

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5919485 A		CA 2216372 A	03-10-1996
		CZ 9703001 A	17-12-1997
		DE 19681287 T	19-03-1998
		DK 109097 A	12-11-1997
		EP 0733367 A	25-09-1996
		FI 973749 A	22-09-1997
		GB 2313783 A,B	10-12-1997
		HU 9800410 A	28-07-1998
		JP 11502848 T	09-03-1999
		LT 97149 A,B	26-01-1998
		LU 90115 A	10-09-1997
		LV 11983 A	20-03-1998
		LV 11983 B	20-07-1998
		NO 974363 A	17-11-1997
		NZ 306111 A	25-02-1999
		PL 322579 A	02-02-1998
		SE 9703206 A	05-09-1997
		SI 9620041 A	30-06-1998
		SK 128297 A	04-03-1998
		TR 9701018 T	21-01-1998
		WO 9629995 A	03-10-1996
WO 0018408 A	06-04-2000	AU 3362799 A	17-04-2000